

Name \_\_\_\_\_

## Algebraic Expressions

**Essential Question** How can you use an algebraic expression to describe a situation?

**CONNECT** You can use what you know about numerical expressions to help you write algebraic expressions.

An **algebraic expression** contains at least one variable.

A **variable** is a letter or symbol that stands for a number or numbers. These are algebraic expressions:

$$\blacksquare + 3 \quad 12 \div n \quad 4 \times \star \quad 3 + (b - 5)$$

You can make a model or write an algebraic expression to describe a situation and to help you find an unknown number.

**A.5.5.2** Write *expressions* containing one *variable* (a letter representing an unknown quantity) using rules for addition and subtraction

### Math Idea

In algebraic expressions, there are several ways to show multiplication. The expression  $5 \times n$  can also be written as  $5 \cdot n$ ,  $5(n)$ , or  $5n$ .

## UNLOCK the Problem

**1** Write an algebraic expression to match the model.

### A Addition

Let  $\blacksquare$  represent 1 and  $\bullet$  represent an unknown number.



Words: 8 plus a number,  $\bullet$

Symbols:  $8 + \bullet$

### B Multiplication

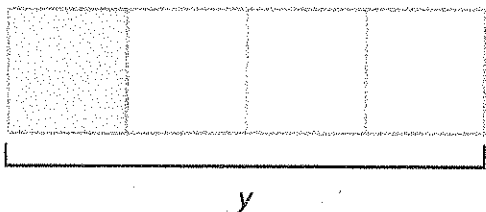
Let  $\bullet$  represent an unknown number.



Words: 4 times a number,  $n$

Symbols: \_\_\_\_\_

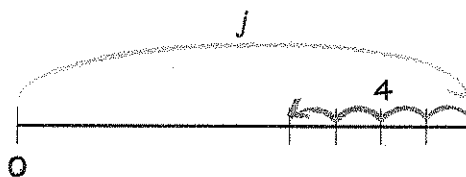
### C Division



Words: \_\_\_\_\_

Symbols:  $y \div 4$

### D Subtraction



Words: \_\_\_\_\_

Symbols: \_\_\_\_\_

**Math Talk** In Example A, why can the expression  $8 + n$  also be used to show  $8 + \bullet$ ?

**Try This!** Model and write an expression to match the words.

- A** Kylie buys a ticket to the water park. She spends \$6 for lunch. How much money does Kylie spend for a ticket and lunch?

Let  $p$  represent the price of a ticket.



**Make a model.**

**Use words and symbols.**

price of  
ticket



\_\_\_\_\_

plus



money spent  
for lunch



\_\_\_\_\_

- B** Daniel sees some dolphins while he is at the water park. He sees 8 times as many turtles as dolphins. How many turtles does Daniel see?

Let  $d$  represent the number of dolphins Daniel sees.

**Make a model.**

**Use words and symbols.**

\_\_\_\_\_



8

\_\_\_\_\_



$\times$

\_\_\_\_\_



$d$

**Example** Write an expression to match the words.

- A** Annie spends 45 minutes going on the rides. Each ride lasts the same amount of time.

Let  $r$  represent the number of rides.

total time    divided by    the number of rides



\_\_\_\_\_ ○ \_\_\_\_\_

What does the expression represent?

\_\_\_\_\_  
\_\_\_\_\_

- B** Carl rents some tubes from the water park for \$3 each.

Let  $t$  represent the number of tubes.

\_\_\_\_\_



\_\_\_\_\_

times



\_\_\_\_\_



\_\_\_\_\_

What does the expression represent?

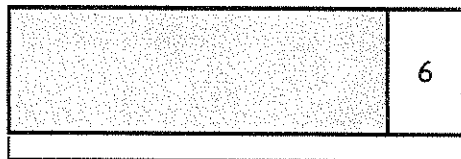
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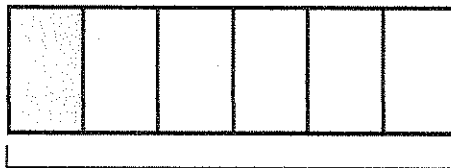
## Share and Show



1. Circle the model that shows the number of tickets,  $t$ , divided equally among 6 people.



$t$



$t$

**Math Talk**

Describe what the model that you did not circle shows.

Model each expression.

2.  $2 \times p$

3.  $w \div 3$

## On Your Own

Practice: Copy and Solve Model each expression.

4.  $23 + t$

5.  $6 - s$

6.  $3 \times m$

7.  $b \div 6$

Model and write an expression that matches the words.

Describe what the expression represents.

8. a handful of keys,  $k$ , divided equally and put on 4 key chains

9. 3 words added to a number of words,  $w$ , in a spelling list

# UNLOCK the Problem REAL WORLD

10. Cody read 10 books during summer vacation. Then he read some more books,  $b$ . What expression shows how many books he read in all?

a. What information will you use?

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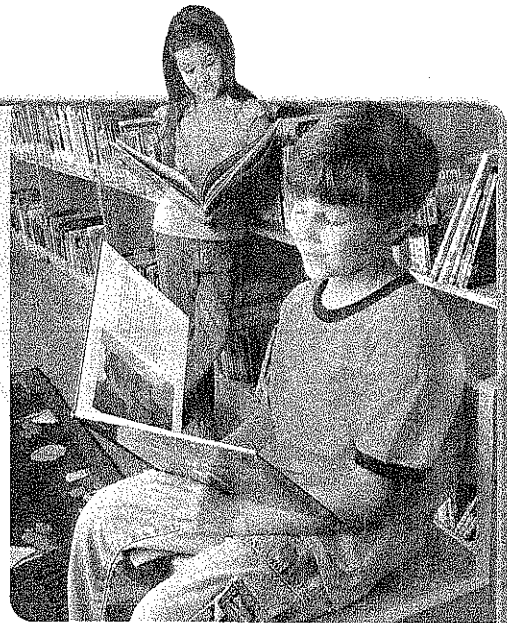
b. What operation would you use to find the number of books he read in all?

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c. Make a model to describe the situation.

d. Write the expression.

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11. Some children,  $c$ , are sitting around a table. Eight of the children leave. Write an expression to show the number of children still at the table.

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12. ★ Test Prep Dan has 6 times as many coins as Suzie. Let  $s$  represent the number of coins Suzie has. Which expression shows the number of coins Dan has?

- ☐ A  $6 + s$   
☐ B  $6 - s$   
☐ C  $6 \times s$   
☐ D  $6 \div s$

Name \_\_\_\_\_

APA

## Evaluate Algebraic Expressions

**Essential Question** How can you use substitution to evaluate an expression?

**A.5.5.3** Select, write, and evaluate *algebraic expressions* with one variable by substitution

You can write and evaluate an expression to solve problems. An **expression** is part of a number sentence. It combines numbers, operation signs, and sometimes variables, but it does not have an equal sign.

### UNLOCK the Problem **REAL WORLD**

James has 4 more than 3 times as many peaches as Kim. If Kim has 2 peaches, how many peaches does James have?



**Write and evaluate an expression with a variable.**

Write an expression to represent the number of peaches that James has for any number of peaches that Kim has.

**STEP 1** Let  $p$  represent the number of peaches Kim has. Look for key words to tell which operations to use.

4 more means to \_\_\_\_\_.

3 times as many means to \_\_\_\_\_.

**STEP 2** Write an expression to represent the number of peaches James has compared to Kim.

4 more than 3 times  $p$  can be written as \_\_\_\_\_.

**STEP 3** Evaluate the expression if  $p = 2$ .

Substitute the number of peaches Kim has for the variable.

\_\_\_\_\_  $\times$  2 + \_\_\_\_\_ = \_\_\_\_\_

So, James has \_\_\_\_\_ peaches.

#### **Remember**

Use the order of operations when evaluating an expression.

1. Would the expression change if Kim had 5 peaches? Explain.

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2. Evaluate the expression if Kim had 5 peaches.

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## Example

Ellis studied for 1 hour less than 2 times as many hours as Shira. If Shira studied for 3 hours, how many hours did Ellis study?

**STEP 1** Write an expression for any number of hours that Shira studied.

Let  $h$  represent the hours.

1 less means to \_\_\_\_\_.

2 times as many means to \_\_\_\_\_.

**STEP 2** Write the expression to represent the number of hours Ellis studied compared to Shira.

1 less than 2 times  $h$  can be written as \_\_\_\_\_.

**STEP 3** Evaluate the expression.

Substitute the number of hours Shira studied for the variable.

\_\_\_\_\_ = \_\_\_\_\_

So, Ellis studied for \_\_\_\_\_ hours.

**Try This!** Evaluate the expression.

Lucinda has 5 more than 3 times as many dolls as Carol. If Carol has 4 dolls, how many dolls does Lucinda have?

- Cecilia records the expression  $3d + 5$ , where  $d$  is the number of dolls that Carol has.
- Andy records the expression  $5d + 3$ , where  $d$  is the number of dolls that Carol has.

Who is correct? \_\_\_\_\_

You can find how many dolls Lucinda has by substituting the number of dolls that Carol has into the expression.

- Write the expression, substituting 4 for  $d$ . \_\_\_\_\_
- Evaluate the expression. \_\_\_\_\_

So, Lucinda has \_\_\_\_\_ dolls.

- Explain how you would evaluate the equation  $6d - 5$ , where  $d = 7$ .

\_\_\_\_\_  
\_\_\_\_\_

Name \_\_\_\_\_

## Share and Show



Write an expression to represent the situation.

1. Ralph has 3 more than 4 times as many models as Kurt. If Kurt has  $k$  models, how many models does Ralph have?

3 more means \_\_\_\_\_.

4 times as many means \_\_\_\_\_.

The expression \_\_\_\_\_ represents the number of models Ralph has.

2. Kaley baked 2 fewer than 3 times as many muffins as Sheldon. If Sheldon baked  $s$  muffins, how many muffins did Kaley bake?

The expression \_\_\_\_\_ represents the number of muffins Kaley baked.

Evaluate.

3.  $2b + 3$ , if  $b = 5$  \_\_\_\_\_

4.  $4c - 6$ , if  $c = 3$  \_\_\_\_\_

### Math Talk

Explain how you know the order in which to perform the operations for item 4.

## On Your Own

Write an expression.

5. Tomas's CD has 3 fewer than 2 times as many songs as Brian's CD. If Brian's CD has  $b$  songs, write an expression for the number of songs that are on Tomas's CD.

\_\_\_\_\_

6. Deidre walked Fido for 5 more than 3 times as many minutes this evening as this morning. If she walked Fido for  $f$  minutes this morning, write an expression for the number of minutes that she walked Fido this evening.

\_\_\_\_\_

Evaluate.

7.  $5g - 4$ , if  $g = 3$  \_\_\_\_\_

8.  $6r + 2$ , if  $r = 4$  \_\_\_\_\_

9.  $3s + 2$ , if  $s = 7$  \_\_\_\_\_

10.  $2x - 4$ , if  $x = 3$  \_\_\_\_\_

# Problem Solving

REAL WORLD

Write and evaluate an expression.

11. Troy has 6 more than 2 times as many games as Craig. If Craig has 4 games, how many games does Troy have?

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12. **NOT** Chris used the expression  $p \div 3 + 12$  to determine how much of the money he earns,  $p$ , to deposit in his bank account. What do you know about the value for  $p$  if the result is a whole-dollar amount being deposited?

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13. Jill has 4 fewer than 3 times as many rolls of pennies as Cappie. If Cappie has 3 rolls of pennies, how many does Jill have?

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14. **Write Math** On Tuesday there were 2 more than 3 times as many books borrowed from the library than on Monday. How many books were borrowed on Tuesday if 15 books were borrowed on Monday? Explain your reasoning.

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15. **★ Test Prep** Warren bought 5 fewer than 4 times as many red balloons as blue balloons. If Warren bought 30 red balloons, how many blue balloons did he buy?

(A) 115

(C) 146

(B) 125

(D) 154

SHOW YOUR WORK



Name \_\_\_\_\_

## Find a Rule

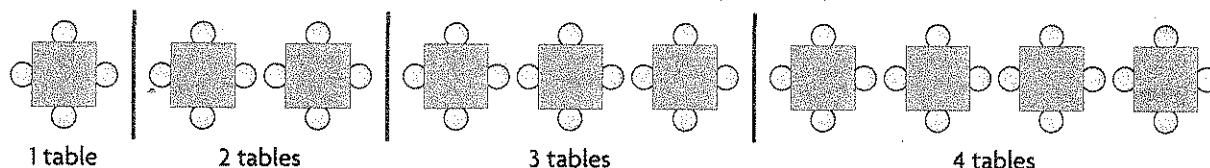
**Essential Question** How can you write a rule for a function?

**A.4.5.2** Interpret and write a rule for a one operation *function table*

### UNLOCK the Problem REAL WORLD

A server at a restaurant is setting up tables for a large group. One table has 4 chairs. Two tables have 8 chairs. Three tables have 12 chairs. Four tables have 16 chairs, and so on. How many chairs are at 5 tables?

- Underline the information you will use.
- Circle the numbers of chairs.



You can use an **input/output table** to show a pattern. A pattern is called a **function** when one quantity depends on the other. The number of chairs that can be used depends on the number of tables used. You can write a rule to describe the relationship between the inputs and outputs of a function.



Use a table to write a rule.

**STEP 1** Complete the input/output table.

**STEP 2** Describe the relationship between tables and chairs.

Think:  $1 \times 4 = 4$       tables  $\times 4 =$  chairs  
 $2 \times 4 = 8$       tables  $\times 4 =$  chairs  
 $3 \times 4 = 12$       tables  $\times 4 =$  chairs  
 $4 \times 4 = 16$       tables  $\times 4 =$  chairs

The number of chairs is \_\_\_\_\_ times the number of tables.

**STEP 3** Find a rule. Use an expression to write your rule.

Think: Use  $t$  for the number of tables.

Rule: The number of chairs is \_\_\_\_\_  $\times$  \_\_\_\_\_.

**STEP 4** Use the rule to find the number of chairs at 5 tables.

The number of chairs at 5 tables is  $4 \times$  \_\_\_\_\_.  
 So, there are 20 chairs at 5 tables.

Input	Output
Tables	Chairs
$t$	$c$
1	
2	
3	
4	



#### ERROR Alert

A rule must work for each pair of numbers in the function table. Be sure to test your rule for each pair of numbers.

#### Math Talk

Explain how you can use the rule to find the number of chairs at 8 tables.



## Examples

- A** Find a rule. Use an expression to write your rule.

The output is \_\_\_\_\_ more than the input.

Use \_\_\_\_\_ for the input.

Rule: The output is \_\_\_\_\_ + \_\_\_\_\_.

Think:

$$2 + \underline{\hspace{1cm}} = 5$$

$$4 + \underline{\hspace{1cm}} = 7$$

$$6 + \underline{\hspace{1cm}} = 9$$

$$8 + \underline{\hspace{1cm}} = 11$$

Input	Output
$b$	$c$
2	5
4	7
6	9
8	11

- B** Use the rule to complete the function table.

Rule: The output is  $n \div 2$ .

		Think: $4 \div 2$		$8 \div 2$	$10 \div 2$	
Input	$n$	2	4	6	8	10
Output	$p$	1		3		5

## Share and Show



1. Use the input/output table to show the pattern. Find a rule.

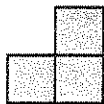


Figure 1



Figure 2

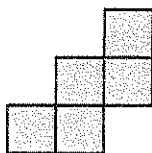


Figure 3

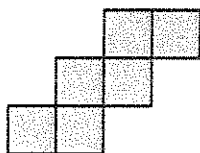


Figure 4

**Rule:** The number of squares is \_\_\_\_\_ + \_\_\_\_\_.

Use the rule to complete the table.

2. Rule: The output is  $n - 5$ .

Input	$n$	10	20	30	40
Output	$p$	5			

Find a rule. Use an expression to write your rule.

3.

Input	$y$	1	2	3	4
Output	$z$	5	6	7	8

4.

Input	$b$	1	2	3	4
Output	$c$	2	4	6	8

Input	Output
Figures	Squares
$f$	$s$
1	
2	
3	
4	

### Math Talk

Explain how you can find a rule.

Rule: \_\_\_\_\_

Rule: \_\_\_\_\_

Name \_\_\_\_\_

## On Your Own .....

Use the rule to complete the table.

5. Rule: The output is  $a \times 5$ .

Input	$a$	2	3	4	5
Output	$b$	10			

6. Rule: The output is  $x - 4$ .

Input	$x$	9	7	5	4
Output	$y$	5			

Find a rule. Use an expression to write your rule.

7.

Input	$r$	5	6	7	8
Output	$t$	11	12	13	14

8.

Input	$n$	15	12	9	6
Output	$p$	5	4	3	2

Rule: \_\_\_\_\_

Rule: \_\_\_\_\_



**Practice: Copy and Solve** Use the rule to make an input/output table.

9. Rule: The output is  $k \div 5$

10. Rule: The output is  $z \times 3$ .

11. Rule: The output is  $p - 3$ .

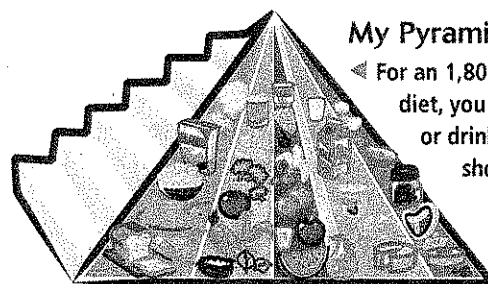
12. Rule: The output is  $w + 4$ .

## Problem Solving **REAL WORLD**

Use the food pyramid for children for 13–14.

13. Complete the input/output table below.  
Find a rule that tells how many cups of milk a child should drink in  $d$  days.

Input	$d$	2	3	4	5
Output	$c$				



**My Pyramid**

◀ For an 1,800-calorie diet, you need to eat or drink the amount shown from each group every day.  
Source: USDA.

Grains 6 ounces	Vegetables $2\frac{1}{2}$ cups	Fruits $1\frac{1}{2}$ cups	Milk 3 cups	Meat & Beans 5 ounces
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14. **Write Math** ▶ How many cups of milk should a child drink in 7 days?  
Explain how you know.

15. ★ Test Prep Which rule works for the table at the right?

Input	$a$	3	4	6	8
Output	$b$	9	12	18	24

- (A) The output is  $a \times 2$ .
- (B) The output is  $a \div 2$ .
- (C) The output is  $a \times 3$ .
- (D) The output is  $a \div 3$ .

## Connect to Science

### Appealing Avocados

Avocados grow in a warm climate. A full-grown avocado tree produces about 150 avocados each year. Each tree uses 20 gallons of water every day.

One gallon of water is equivalent to 4 quarts of water. You can write a rule to show this.

Let  $g$  represent the number of gallons of water, the input, and let  $q$  represent the total number of quarts of water, the output.

**Rule:** The number of quarts is  $g \times 4$ .

1. Use the rule to complete the input/output table.

Input	Gallons	$g$	1	2	4	6
Output	Quarts	$q$				

2. What if there are 36 quarts of water?  
How many gallons of water are there? \_\_\_\_\_
3. ★HOT One gallon of water equals 4 quarts of water and 1 quart of water equals 2 pints of water. How many pints of water equal 1 gallon of water? Explain.

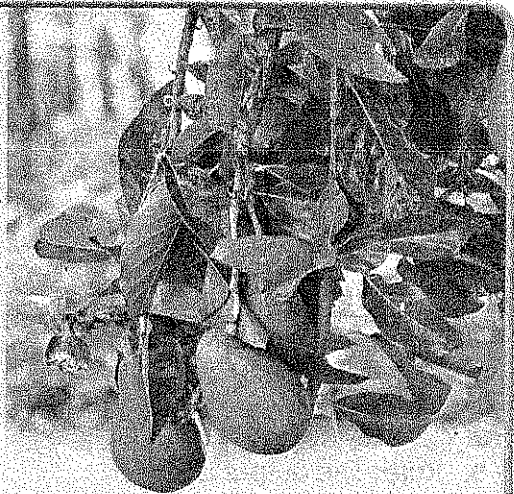
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Name \_\_\_\_\_

AR6

## Addition Equations

**Essential Question** How can an equation with addition be solved by using subtraction?

**A.5.5.1** Model and solve simple equations by informal methods using manipulatives and appropriate technology

### UNLOCK the Problem REAL WORLD

Yara is going camping in the Everglades National Park. Her backpack with camping gear weighs 17 pounds. When she adds her camera gear, the total weight of her backpack is 25 pounds. How much does Yara's camera gear weigh?

- What does the backpack weigh without the camera gear? \_\_\_\_\_
- What do you need to find? \_\_\_\_\_

### One Way Use a model.

Solve the problem by using the equation  $17 + c = 25$ , where  $c$  is the weight of the camera gear.

#### STEP 1

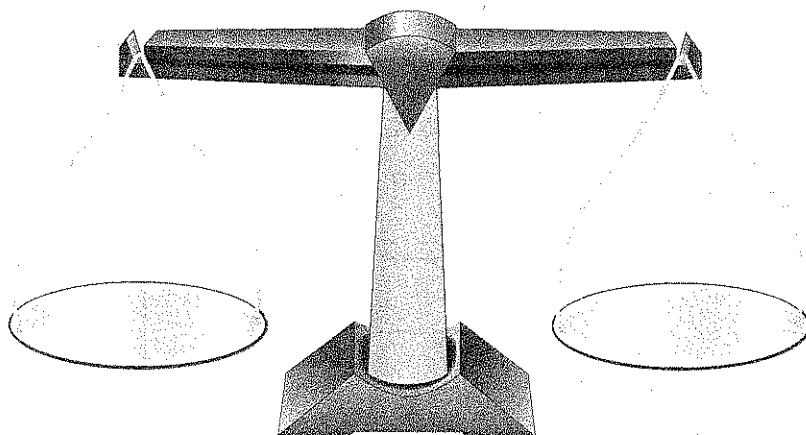
Draw a picture to model the equation  $17 + c = 25$  on the pan balance below.

- Use 1 square to represent 1 pound.
- Use a circle for  $c$ , the unknown weight of the camera gear.

#### STEP 2

Cross out the same number of squares from each pan until only the circle representing the unknown weight is left in one pan. The value of the variable is shown by the other pan.

- What is the greatest number of squares that you can cross out equally from both pans?  
\_\_\_\_\_



$c =$  \_\_\_\_\_

So, Yara's camera gear weighs \_\_\_\_\_ pounds.





## Another Way Use inverse operations.

Addition and subtraction are inverse operations. Inverse operations reverse each other. This addition equation has a variable on one side, with a number added to it:

$$x + 4 = 7$$

The inverse operation of adding 4 to the variable is subtracting 4. Using the inverse operation will solve the equation for  $x$ . Remember to subtract 4 from both sides of the equation to keep it balanced.

$$x + 4 - 4 = 7 - 4$$

$$x = 3$$

**Solve the equation. Check your solution.**

Write the equation.

$$c + 17 = 25$$

Use the inverse operation.

$$c + 17 - \underline{\hspace{2cm}} = 25 - \underline{\hspace{2cm}}$$

Use the Identity Property.

$$c + 0 = 8$$

$$c = \underline{\hspace{2cm}}$$

Check your solution.

$$c + 17 = 25$$

Replace  $c$  with  $\underline{\hspace{2cm}}$ .

$$\underline{\hspace{2cm}} + 17 = 25$$

Does your solution check?  $\underline{\hspace{2cm}}$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

**Try This!** Use inverse operations to solve the equation. Check your solution.

**SOLVE**

$$13 + d = 22$$

$$13 - \underline{\hspace{2cm}} + d = 22 - \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} + d = \underline{\hspace{2cm}}$$

$$d = \underline{\hspace{2cm}}$$

**CHECK**

$$13 + d = 22$$

$$13 + \underline{\hspace{2cm}} = 22$$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

- Can  $d$  in  $13 + d = 22$  have more than one value? Why or why not?

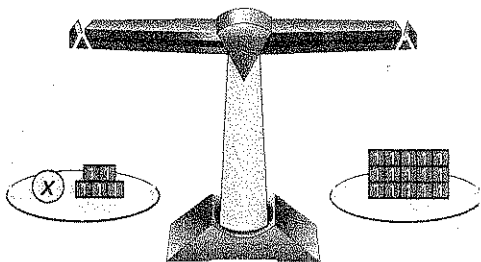
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# Share and Show



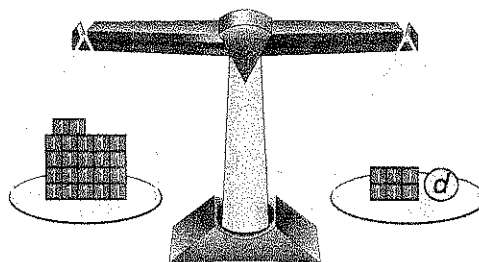
Solve the equation. Check your solution.

1.  $x + 5 = 15$



$x =$  \_\_\_\_\_

2.  $22 = 6 + d$



\_\_\_\_\_  $= d$

3.  $98 = y + 63$

4.  $10 + p = 33$

5.  $82 = b + 49$

**Math Talk** Explain how and why you should check your solution.

\_\_\_\_\_  $= y$

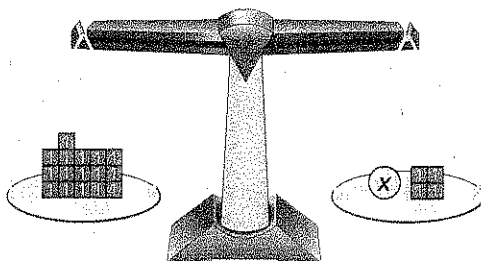
$p =$  \_\_\_\_\_

\_\_\_\_\_  $= b$

## On Your Own

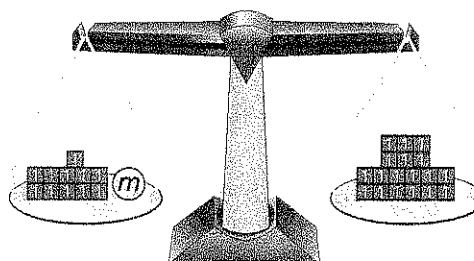
Solve the equation. Check your solution.

6.  $16 = x + 4$



\_\_\_\_\_  $= x$

7.  $11 + m = 18$



$m =$  \_\_\_\_\_

8.  $85 = 67 + a$

9.  $48 = w + 14$

10.  $79 + n = 98$

11.  $22 + b = 44$

\_\_\_\_\_  $= a$

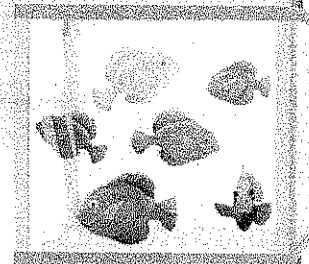
\_\_\_\_\_  $= w$

$n =$  \_\_\_\_\_

$b =$  \_\_\_\_\_

12. Isaac and Maizie work at a pet store. It is their job to count the number of tropical fish in all the tanks at the end of the day. Isaac counted 69 fish, and Maizie counted the rest of the fish. Together, Maizie and Isaac counted 133 fish. How many tropical fish did Maizie count?

(A) 36      (B) 64      (C) 138      (D) 202



a. What do you need to know? \_\_\_\_\_

\_\_\_\_\_

b. Let  $f$  represent the number of fish Maizie counted. What equation can you write to represent the problem? \_\_\_\_\_

c. How can you use inverse operations to solve the equation?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

d. Solve the equation.

Maizie counted \_\_\_\_\_ fish.

Fill in the bubble for the correct answer choice.

13. Wes had some money in his wallet and \$39 in his pocket. He had \$76 in all. He could represent his money by using the equation  $39 + m = 76$ . How much did Wes have in his wallet?

(F) \$115  
(G) \$105  
(H) \$47  
(I) \$37

14. Mrs. Kelly's class spent \$46 on a graduation party. The class spent \$7 on paper supplies and the rest on food. How much did Mrs. Kelly's class spend on food?

(A) \$53  
(B) \$46  
(C) \$39  
(D) \$14



Name \_\_\_\_\_

## Subtraction Equations

**Essential Question** How can an equation with subtraction be solved by using addition?

**A.5.5.1** Model and solve simple equations by informal methods using manipulatives and appropriate *technology*

**CONNECT** You have learned that if you subtract the same number from both sides of an equation, both sides remain equal.

### UNLOCK the Problem REAL WORLD

What happens when you add the same amount to both sides of an equation? Do the sides remain equal?

If you add the same number to both sides of an equation, the two sides remain equal.

$$\begin{aligned} 7 &= 7 \\ 7 + 3 &= 7 + 3 \\ 10 &= 10 \end{aligned}$$

### Activity Use a Model.

**Materials** ■ pan balance ■ connecting cubes

#### STEP 1

Model the equation  $5 = 8 - 3$  on a pan balance. Remove cubes to show subtraction.

- Explain how you modeled the expression  $8 - 3$ .

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#### STEP 2

Add 2 cubes to both pans.

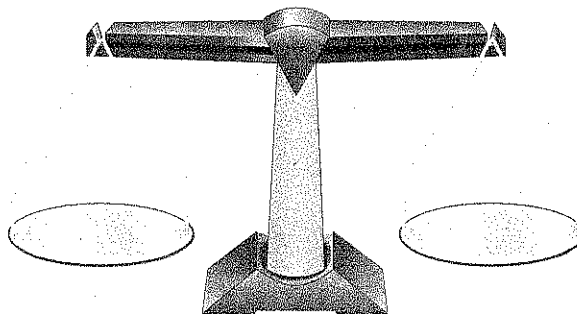
- Are the pan balanced after you add 2 cubes to both pans? Explain why or why not.

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Draw a picture of your model.



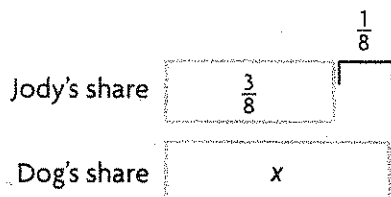
So, when you add the same amount to both sides of an equation, both sides remain equal.



## Example Use inverse operations.

Jody ate  $\frac{3}{8}$  of a whole pizza. The pizza fell on the floor and her dog ate some of it. Jody ate  $\frac{1}{8}$  less of the pizza than her dog. Write and solve an equation where  $x$  is equal to the amount of pizza that the dog ate.

- Use this bar model to write the equation.



Jody's share      Dog's share       $\frac{1}{8}$  less

$$\underline{\hspace{2cm}} = x - \underline{\hspace{2cm}}$$

- Solve the equation.

Write the equation.

$$\frac{3}{8} = x - \frac{1}{8}$$

Use the inverse operation:  $\underline{\hspace{2cm}}$

$$\frac{3}{8} + \underline{\hspace{2cm}} = x - \frac{1}{8} + \underline{\hspace{2cm}}$$

Use the Identity Property.

$$\underline{\hspace{2cm}} = x + 0$$

Solve for the unknown variable.

$$\underline{\hspace{2cm}} = x$$

- Check your solution.

$$\frac{3}{8} = x - \frac{1}{8}$$

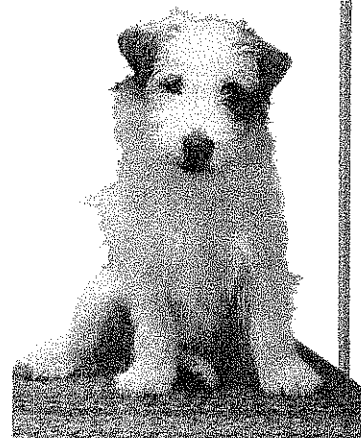
Replace  $x$  with  $\underline{\hspace{2cm}}$ .

$$\frac{3}{8} = \underline{\hspace{2cm}} - \frac{1}{8}$$

Does your solution check?  $\underline{\hspace{2cm}}$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

So, the dog ate  $\underline{\hspace{2cm}}$  of the pizza.



## Share and Show



Solve the equation.

1.  $x - 7 = 15$  Add  $\underline{\hspace{2cm}}$  to both sides.

$$x - 7 + \underline{\hspace{2cm}} = 15 + \underline{\hspace{2cm}}$$

$$x + \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

$$x = \underline{\hspace{2cm}}$$

2.  $9 = y - 10$  Add  $\underline{\hspace{2cm}}$  to both sides.

$$9 + \underline{\hspace{2cm}} = y - 10 + \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} = y + \underline{\hspace{2cm}}$$

$$\underline{\hspace{2cm}} = y$$

Name \_\_\_\_\_

## Share and Show



Use inverse operations to solve the equation. Check your solution.

3.  $y - 4 = 9$

$y = \underline{\hspace{2cm}}$

Check

4.  $10 = p - 10$

$\underline{\hspace{2cm}} = p$

Check

5.  $52 = s - 14$

$\underline{\hspace{2cm}} = s$

Check

6.  $w - 2 = 32$

$w = \underline{\hspace{2cm}}$

Check

7.  $k - 7 = 39$

$k = \underline{\hspace{2cm}}$

Check

8.  $b - 12 = 41$

$b = \underline{\hspace{2cm}}$

Check

9.  $12 = h - 25$

$\underline{\hspace{2cm}} = h$

Check

### Math Talk

Explain why you can add to solve a subtraction equation.

## On Your Own

Use inverse operations to solve the equation. Check your solution.

10.  $n - 26 = 11$

$n = \underline{\hspace{2cm}}$

Check

11.  $a - 9 = 15$

$a = \underline{\hspace{2cm}}$

Check

12.  $37 = p - 62$

$\underline{\hspace{2cm}} = p$

Check

13.  $6 = y - 43$

$\underline{\hspace{2cm}} = y$

Check

**Practice: Copy and Solve** Use inverse operations to solve the equation. Check your solution.

14.  $29 = f - 62$

15.  $m - 57 = 3$

16.  $93 = r - 15$

17.  $a - 26 = 71$

18.  $n - 33 = 34$

19.  $27 = d - 31$

20.  $m - 12 = 23$

21.  $47 = x - 18$

# Problem Solving

REAL WORLD

Use the bar graph to solve for 22–24.

22. Taking a shower uses about 13 gallons less water than taking a bath. About how many gallons of water are used for taking a bath?

Use the equation  $b - 13 = 23$ , where  $b$  is equal to the number of gallons of water needed for a bath.

23. Washing the dishes uses about 29 gallons less water than washing a load of laundry. How many gallons of water are used to wash a load of laundry?

Use the equation  $l - 29 = 15$ , where  $l$  is equal to the number of gallons of water needed for a load of laundry.

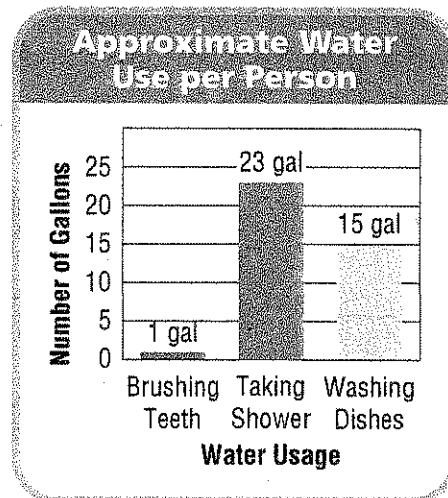
24. **Write Math** You use 2 gallons less water to brush your teeth than to wash your hands. Find how much water you use to wash your hands.

Write an equation you can use to solve the problem. Use  $h$  to represent the number of gallons of water used to wash your hands. Then solve the equation.

25. **★ Test Prep** The Colts scored 16 points, which was 12 fewer points than the Yearlings scored. How many points did the Yearlings score?

Use the equation  $y - 12 = 16$ , where  $y$  is equal to the Yearlings' score.

- (A)  $y = 4$       (C)  $y = 24$   
(B)  $y = 8$       (D)  $y = 28$



SHOW YOUR WORK

Name \_\_\_\_\_

AR3

## Multiplication Equations

**Essential Question** How can you solve equations with multiplication by using division?

**A.5.5.1** Model and solve simple *equations* by informal methods using manipulatives and appropriate *technology*

### UNLOCK the Problem REAL WORLD

At the movies, Jake bought 3 bags of popcorn for himself and his friends Larry and Sal. Each bag of popcorn was the same price. Jake paid \$12 for the 3 bags. How much did each bag of popcorn cost?

The price of 3 bags of popcorn is  $3 \times p$ . Solve the equation  $3 \times p = 12$ , where  $p$  is the price of one bag of popcorn.

- How does knowing there are 2 or more items at the same price help you choose an operation to write an equation?

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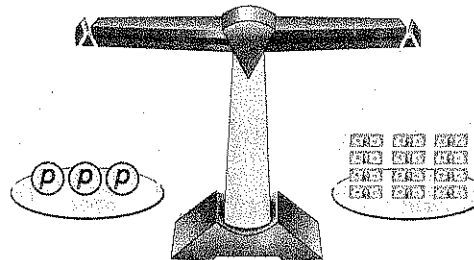
### One Way Use a model.

#### STEP 1

Model the equation  $3 \times p = 12$  by drawing a picture on the pan balance.

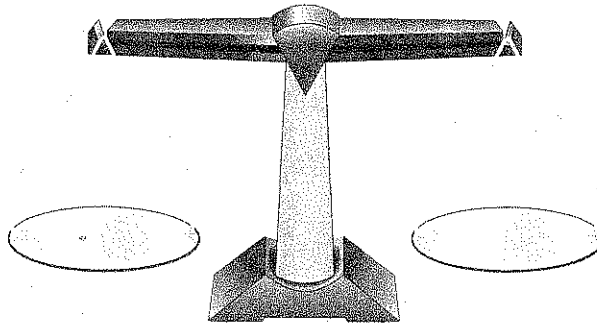
On one pan, draw \_\_\_\_\_ circles, each representing the price of one of three bags of popcorn.

On the other pan, draw \_\_\_\_\_ ones in 3 equal groups, one group for each  $p$ .



#### STEP 2

On your drawing, cross out a group of ones and one  $p$ . Keep doing this until only one group of ones and one  $p$  are left. The number in the remaining group is equal to the value of the variable,  $p$ .



So, 1 bag of popcorn cost \_\_\_\_\_.



## Another Way Use inverse operations.

Multiplication and division are inverse operations. You can use division to solve multiplication equations.

**Solve the equation. Check your solution.**

Write the equation.

$$3 \times p = 12$$

Use the inverse operation, division.

$$3 \div 3 \times p = 12 \div \underline{\hspace{2cm}}$$

Use the Identity Property.

$$\underline{\hspace{2cm}} \times p = \underline{\hspace{2cm}}$$

$$p = \underline{\hspace{2cm}}$$

Check your solution.

$$3 \times p = 12$$

Replace  $p$  with your answer.

$$3 \times \underline{\hspace{2cm}} = 12$$

Does your solution check?  $\underline{\hspace{2cm}}$

$$\underline{\hspace{2cm}} = \underline{\hspace{2cm}}$$

### Remember

The expression  $3 \times p$  can also be written as  $3p$  or  $3 \cdot p$ . These expressions represent 3 times the variable  $p$ .

## Try This! Solve the equation.

When solving an equation with two operations, you need to use two inverse operations to get the variable by itself on one side of the equation. To get the variable by itself, the order of operations is reversed so that addition and subtraction is undone first before multiplication and division.

$$6 \times n + 3 = 27$$

$$6 \times n + 3 - \underline{\hspace{2cm}} = 27 - \underline{\hspace{2cm}}$$

Use the inverse operation, subtraction.

$$6 \times n = \underline{\hspace{2cm}}$$

$$6 \div \underline{\hspace{2cm}} \times n = 24 \div \underline{\hspace{2cm}}$$

Use the inverse operation, division.

$$1 \times n = \underline{\hspace{2cm}}$$

Use the Identity Property.

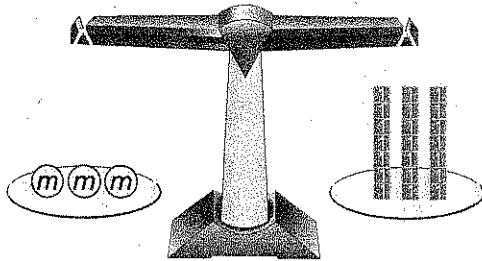
$$n = \underline{\hspace{2cm}}$$

Name \_\_\_\_\_

## Share and Show.....

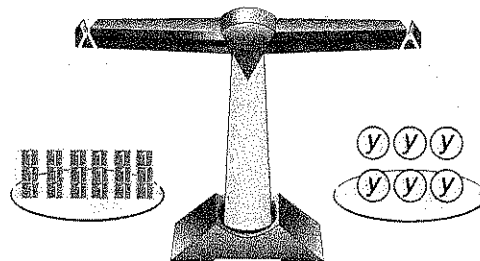
Use a model or inverse operations to solve the equation. Check your solution.

1.  $3 \times m = 21$



$m = \underline{\hspace{2cm}}$

2.  $18 = 6y$



$\underline{\hspace{2cm}} = y$

3.  $54 = 9z$

$\underline{\hspace{2cm}} = z$   
Check

4.  $12d = 60$

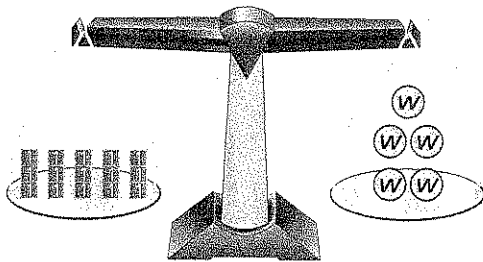
$d = \underline{\hspace{2cm}}$   
Check

**Math Talk** Explain why you would divide both sides of the equation  $4m = 32$  by 4.

## On Your Own.....

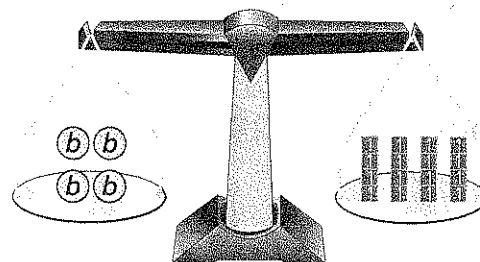
Solve the equation. Check your solution.

5.  $15 = 5w$



$\underline{\hspace{2cm}} = w$

6.  $4b = 16$



$b = \underline{\hspace{2cm}}$

**Practice: Copy and Solve** Use inverse operations to solve the equation. Check your solution.

7.  $128 = 8 \times d$

8.  $119 = 7h$

9.  $11v = 132$

10.  $143 = 13 \times k$

11.  $105 = 7t$

12.  $6m = 78$

13.  $91 = 5 \times n + 6$

14.  $4b - 3 = 41$

# Problem Solving


REAL WORLD


Use the table to solve 15–17.


15. The drama club sees a movie. Each member of the club buys one fruit snack. The club spends a total of \$76 on fruit snacks. How many members of the club went to the movies? Solve the equation  $4f = 76$ , where  $f$  represents the number of fruit snacks bought.

Snack Bar Menu	
Large Popcorn	\$8
Medium Drink	\$5
Fruit Snack	\$4
Candy Bars	\$3
Family Combo	\$18

16. On Friday, the snack bar made \$992 selling buckets of large popcorn. How many buckets of large popcorn did the snack bar sell on Friday? Solve the equation  $8p = 992$ , where  $p$  represents the number of buckets of large popcorn sold.

17.  On Thursday, the snack bar made a total of \$340 in medium drink sales and a total of \$216 in candy bar sales. Which item did the snack bar sell more of on Thursday? Explain how you found your answer.

18.  Michael solves the equation  $8y = 2$  and finds that  $y$  is equal to 16. Explain how you know Michael's solution is not correct.

19.  **Test Prep** Rick earned \$133 for 7 hours of work. How much does Rick earn per hour? The equation  $7p = 133$  can be used to find  $p$ , the amount Rick earns per hour.

(A) \$6

(C) \$69

(B) \$19

(D) \$95

SHOW YOUR WORK



Name \_\_\_\_\_

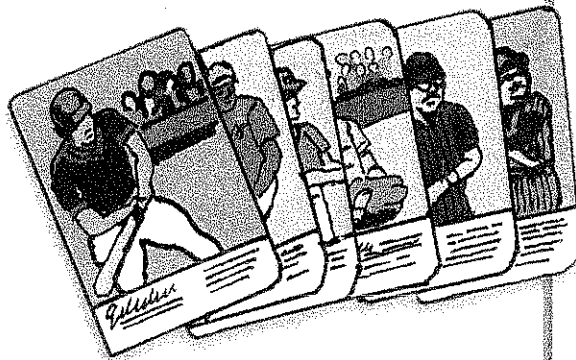
## Division Equations

**Essential Question** How can you solve division equations by using multiplication?

**A.5.5.1** Model and solve simple equations by informal methods using manipulatives and appropriate technology

### UNLOCK the Problem REAL WORLD

Steven buys a package of trading cards. He divides the cards into 4 equal piles. Each pile contains 12 cards. The equation that describes the number of cards in the package is  $c \div 4 = 12$ . How many cards were in the package when Steven bought it?



In the expression  $c \div 4$ , you can use the inverse operation, multiplication, to undo the division.

### One Way Use inverse operations.

Use the equation  $\frac{c}{4} = 12$  to find  $c$ , the number of cards in the package Steven bought.

Write the equation.

$$\frac{c}{4} = \underline{\hspace{2cm}}$$

Use the inverse operation, multiplication.

$$\frac{c}{4} \times \underline{\hspace{2cm}} = 12 \times \underline{\hspace{2cm}}$$

Use the Identity Property.

$$c \times 1 = \underline{\hspace{2cm}}$$

$$c = \underline{\hspace{2cm}}$$

Division expressions can be written as fractions.

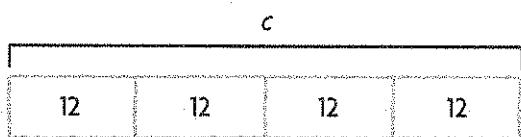
$$x \div 2 = \frac{x}{2}$$

$$12 \div 3 = \frac{12}{3}$$

### Another Way Write a related equation.

#### MODEL

- Use a bar model to represent the problem.



#### SOLVE

- Write a related multiplication equation.

Multiplication equation: \_\_\_\_\_

$$c = \underline{\hspace{2cm}}$$

So, the package Steven bought had \_\_\_\_\_ trading cards in it.

**Try This!** Solve the equations to answer the question.

Meagan has two card-collection books. The first book has 8 cards on each of 14 pages. The second has 6 cards on each of 15 pages. Which of the two books has more cards?



**STEP 1** Solve the equation  $\frac{b}{8} = 14$  to find the number of cards in the first book. Let  $b$  equal the number of cards in the first book.

**SOLVE**

$$\begin{array}{l} \frac{\text{[card icon]}}{8} = \underline{\hspace{2cm}} \\ \frac{\text{[card icon]}}{8} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \end{array}$$

**CHECK**

$$\begin{array}{l} \underline{\hspace{2cm}} \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \end{array}$$

**STEP 2** Solve the equation  $\frac{p}{6} = 15$  to find the number of cards in the second book. Let  $p$  equal the number of cards in the second book.

**SOLVE**

$$\begin{array}{l} \frac{\text{[card icon]}}{6} = \underline{\hspace{2cm}} \\ \frac{\text{[card icon]}}{6} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \end{array}$$

**CHECK**

$$\begin{array}{l} \underline{\hspace{2cm}} \div \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \\ \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \end{array}$$

**Math Talk**

Explain why you use multiplication to solve a division equation.

**STEP 3** Compare the number of cards in each book.

The first book has \_\_\_\_\_ cards.

The second book has \_\_\_\_\_ cards.

So, the \_\_\_\_\_ book has more cards.

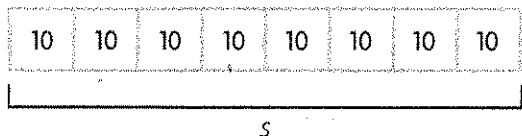
Name \_\_\_\_\_

## Share and Show



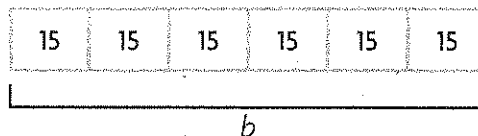
Use the bar model to write an equation. Then solve.

1. A caterer is making sandwiches from 8 loaves of bread. Each loaf makes 10 sandwiches. How many sandwiches is she making? Let  $s$  equal the total number of sandwiches.



She is making \_\_\_\_\_ sandwiches.

2. A gardener is planting 6 rows of spring bulbs. Each row has 15 bulbs. How many bulbs is he planting? Let  $b$  equal the total number of bulbs.



He is planting \_\_\_\_\_ bulbs.

Use inverse operations to solve. Check your solution.

3.  $\frac{k}{7} = 13$

$k =$  \_\_\_\_\_

Check:

4.  $15 = \frac{c}{7}$

$c =$  \_\_\_\_\_

Check:

5.  $18 = \frac{b}{9}$

$b =$  \_\_\_\_\_

Check:

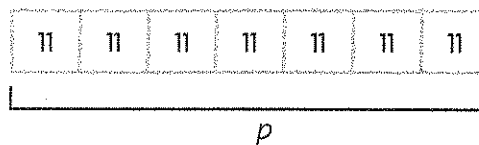
### Math Talk

Explain how the bar models for multiplication and division are related.

## On Your Own

Use the bar model to write an equation. Then solve.

6. A junior league of 7 baseball teams has 11 players on each team. How many players are in the league? Let  $p$  represent the number of players in the league.



**Practice: Copy and Solve** Use inverse operations to solve the equation.

7.  $25 = \frac{g}{20}$

8.  $\frac{w}{16} = 9$

9.  $17 = \frac{r}{9}$

10.  $\frac{t}{13} = 22$

11.  $7 = \frac{b}{17}$

12.  $\frac{f}{8} = 14$

13.  $13 = \frac{k}{6}$

14.  $\frac{w}{5} = 15$

# Problem Solving

REAL WORLD

Use a bar model to write an equation. Then solve.

15. Eric has a collection of baseball cards. He divides the cards equally among 15 containers. Each container has 10 cards. How many cards does Eric have? Let  $c$  represent the number of cards Eric has.

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16. Mary has a game that comes with playing tokens. When she divides the tokens among herself and 4 friends, each person receives 11 tokens. How many tokens,  $t$ , came with the game?

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17. **Hot** Asher wants to buy a video game console. In order to save the money needed to buy it in 5 months, he divides the cost by 5. He finds he needs to save \$37 a month. What is the total cost,  $c$ , of the game console?

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18. **Write Math** Jasmine says that  $x = 348$  is the solution to  $x \div 12 = 29$ . Explain how you can justify Jasmine's solution.

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19. **★ Test Prep** The cost of a pizza is shared equally by 6 people. Each person contributes \$5. Which equation could be used to find  $c$ , the cost of the pizza?

(A)  $\frac{6}{c} = 5$

(B)  $\frac{5}{c} = 6$

(C)  $\frac{6}{5} = c$

(D)  $\frac{c}{6} = 5$

SHOW YOUR WORK